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REVIEWS

Triassic Ichthyosauria, with Special Reference to the American Forms.

By JOHN C. MERRIAM. Memoirs of the University of California, Vol. I, No. 1, pp. 1-196, pls. 1-18, 1908.

Just forty years ago the late Professor Leidy described some fragmentary remains of ichthyosaurs from the Triassic of Nevada, the first known representatives of the order from America. About ten years later Professor Marsh made known a much more highly specialized form, *Baptanodon*, from the Jura-Cretaceous of Wyoming, a form which has been recently well described by Mr. Gilmore. Until 1895, nothing was added to our very meager knowledge of the early types from America and not much from other parts of the world. Since that time, however, Professor Merriam, the author of the present memoir, has been engaged almost continuously in the collection and study of the abundant, but often refractory remains of these animals from the Trias of the Pacific region, the final and praiseworthy results of which are embodied in the present work. In addition to the description of Leidy's *Cymbospondylus* he has founded no less than four other genera, *Torotocnemus*, *Merriamia*, *Delphinosaurus*, and *Shastosaurus*. *Mixosaurus*, *Ophthalmosaurus*, and *Ichthyosaurus* are the only other known genera of the order, hitherto unknown from America with certainty.

From the time when Scheuchser two centuries ago made known some vertebrae of an ichthyosaur from Altorf as those of a human being who had come to grief in the Noachian deluge, the group of ichthyosaurs have been of special interest to all classes, and much has been written about them in literature both grave and light. So perfectly were they adapted for aquatic life that it had been generally assumed, until 1887, that they were directly derived from the fishes. Baur it was, who, in the year mentioned, showed conclusively from the study of the only, and imperfectly known European Triassic form, *Mixosaurus*, that the animals must have sprung from some terrestrial crawling reptiles. A further knowledge, therefore, of the unexpectedly rich and varied ichthyosaurian fauna which has been brought to light by Dr. Merriam from the Triassic deposits of the Pacific region since 1895 when he began his energetic studies of this group, are peculiarly welcome to all interested in extinct animals and their evolution. So important are the many positive demonstrations of evolution in these forms which the

author's studies disclose, that it will be of interest briefly to summarize the more noteworthy of them. Perhaps no more familiar type of an aquatic carnivorous vertebrate can be suggested than the common gar-pike of America, a long, smooth body, short neck, propelling tail, guiding, loosely connecting fins, slender jaws, etc. The later ichthyosaurs approach such a type more closely than do or have any other air-breathing animals, in their long body, short neck, extraordinary tail-fin, paddle-like limbs, long jaws, large eyes, etc., and it is very evident that in the transition from forms not unlike a common lizard in external appearance, the animals must have passed through very great changes. In the Triassic forms chiefly those from California, Dr. Merriam has demonstrated a progressive adaptation in all these and in other characters. The locomotion of these early forms was more by aid of the limbs and less by the tail, the limbs were larger, with fewer bones, more elongated arm bones, the hind limbs were larger to supply the deficiency of a weaker tail, their connection with the trunk was stronger, the pelvis was heavier, the connection of the vertebrae with each other was more of the terrestrial kind—the vertebrae were more elongated, that is, less fish-like, etc. The skull was shorter, the jaws relatively less elongated, the teeth were more firmly fixed, the eyes were smaller, the ears less well adapted for deep diving, and the neck was less short. But it is in the tail that the most interesting progressive adaptation is seen. Every one knows how remarkable was the terminal caudal fin of the late ichthyosaurs. Dr. Merriam shows that the early forms were progressively modified from the simple flattened tail, as in the crocodile, to a tail with a preterminal dilatation like that of the mosasaurs having little or no downward bend; to the gradual turning downward of the distal end and the great expanse of the terminal, quite fish-like caudal fin. It is only in the ribs that modifications seem to have arisen not in conformity with the laws of aquatic specialization. The early forms had them attached to the centrum by a single head, while the later ones are predominantly bicipital. However, the writer has little doubt that this primitive branch of the reptilian stem began with single-headed ribs, and that the acquisition of a double-headed attachment of a kind almost peculiarly their own, has been an independently acquired character. On the other hand, it seems very certain that a similar mode of attachment in the neck ribs of the plesiosaurs was a primitive character which has been lost in all the late forms. As the author says: "Not only is the stage of development of the Triassic representatives nearer the stem or semi-aquatic reptilian type than in the later ones, but a definite and fairly regular gradation or progressive specialization from the earliest forms to the latest seems to be recognizable in many parts of the skeleton."

But alas, notwithstanding all these conclusive evidences of evolution from a still earlier terrestrial type the Triassic forms offer no conclusive evidence of the origin of the order. The author can see no especial rhynchocephalian characters in the ichthyosaurs, so strongly urged by Baur, and he rejects the conclusions of McGregor that the ichthyosaurs are nearly related to the phytosaurs, and in both these conclusions the writer concurs. He believes that the ichthyosaurs arose from very primitive or the most primitive reptiles. Hay, recently in his extensive work on the turtles has reached the same conclusion for that order of reptiles. In other words, the results of both these authors, based upon exhaustive studies, go to support the phylogenic views expressed by Cope in his *Factors of Evolution*, published not long before his death. It seems to the writer they also destroy every shred of support remaining for the primary division of the reptilia into two chief classes, and the writer further protests against the use of the terms "Synapsida" and "Diapsida" as practically synonyms of Cope's Synaptosauria and Archosauria, proposed and sustained by him years before his death.

Briefly stated in conclusion, Dr. Merriam gives a full discussion of the geological and geographical distribution of the ichthyosaurs, their classification (he accepts Baur's two families only, the Mixosauridae and Ichthyosauridae), evolution, and structure, with especial reference to the Triassic forms, which are fully described so far as the known material has permitted. The work is well illustrated by text figures and plates.

Both the author and the University of California are to be congratulated upon the issuance of this volume, and not the least is the university to be commended for the inauguration of the handsome series of quarto memoirs of which this is the beginning; other institutions might well profit by the example.

S. W. W.

Skeletal Remains Suggesting or Attributed to Early Man in North America. By ALEŠ HADLIČKA. Bureau of American Ethnology, Bulletin No. 38, Washington, D. C., 1907.

This is a very careful, dispassionate review of the skeletal remains found at New Orleans, Quebec, Natchez, Lake Monroe (Florida) Soda, Creek, Charleston, Galaveras, Rock Bluff, Penon, Trenton, Burlington, Riverview, Lansing, Osprey, Hanson Landing, and Nebraska. The discussion of the Nebraska "loess man," which is based on personal examination of the grounds as well as study of the remains, is the climacteric point of interest, because of the low, retreating foreheads of some of the skulls. Hadlička's general conclusion (p. 98) is as follows: